PB80-183395

Fish, Wildlife, and Estuaries Pesticide Residues in Estuarine Mollusks 1977 versus 1972-National Pesticide Monitoring Program

(U.S.) Environmental Research Lab.
Gulf Breeze, FL

Dec 78

U.S. Department of Commerce
National Technical Information Service
NTIS

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1. REPORT NO. EPA-600/J-78-168	2. JOURNAL ARTICLE	3. RECIPIE PB1 PB80-183395
4. TITLE AND SUBTITLE: PESTICIDES RESIDUES IN ESTUARINE MOLLUSKS, 1977 VERSUS 1972--NATIONAL PESTICIDE MONITORING PROGRAM		5. REPORT DATE
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S): Philip A. Butler, Charles D. Kennedy, and Roy A. Schutzmann		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT NO. 1EA615
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS: Environmental Research Laboratory, Gulf Breeze, FL Office of Research and Development U.S. Environmental Protection AGency, Sabine Island Gulf Breeze, Florida 32561		13. TYPE OF REPORT AND PERIOD COVERED: Final
		14. SPONSORING AGENCY CODE: EPA/600/04

15. SUPPLEMENTARY NOTES
Reference: Pesticides Monitoring Journal, Vol. 12, No. 3, December 1978, pp. 99-101.

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17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
Pesticides Toxic compounds Aquatic	Dieldrin Monitoring Mollusks	06/F 06/S 08/A

18. DISTRIBUTION STATEMENT: Unlimited	19. SECURITY CLASS *(This Report)*: Unclassified	21. NO. OF PAGES: 3
	20. SECURITY CLASS *(This page)*: Unclassified	22. PRICE

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

EPA-600/J-78-168
JOURNAL ARTICLE

FISH, WILDLIFE, AND ESTUARIES

Pesticide Residues in Estuarine Mollusks, 1977 versus 1972— National Pesticide Monitoring Program

Philip A. Butler,[1] Charles D. Kennedy,[2] and Roy L. Schutzmann[2]

ABSTRACT

Bivalve mollusks were monitored for residues of 20 organochlorine and organophosphate pesticides and polychlorinated biphenyls in spring 1977 in 87 of the 181 estuaries routinely monitored on a monthly basis during 1965–72. DDT, the only pesticide detected in 1977, occurred at low levels in one estuary each on the Atlantic and Pacific coasts.

Introduction

In 1965 the U.S. Bureau of Commercial Fisheries initiated a program to monitor shellfish populations for organochlorines. In cooperation with local laboratories, about 180 permanent monitoring stations in 15 coastal states were sampled for any one of 10 species of mollusks monthly. The eastern oyster, *Crassostrea virginica*, was the principal species collected on the Atlantic coast, and *C. gigas* was the species usually monitored on the Pacific coast. The program continued until 1972, but not all areas were monitored for the entire period. About 8,100 samples containing 15 pooled individuals were analyzed. DDT was found in almost all samples. Dieldrin was the next most commonly detected pesticide: residues of endrin, mirex, toxaphene, and polychlorinated biphenyls (PCBs) were detected occasionally. By 1972, there was a clearly defined trend toward fewer and smaller residues of DDT and its metabolites (*1*).

Early in 1977, the U.S. Environmental Protection Agency monitored mollusks at some of the same sites to determine further trends in pollution levels after the 5–7-year lapse.

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Materials and Methods

The original cooperating laboratories agreed to collect the new samples. About half the former stations where pesticides had been found consistently a decade ago were monitored again. Single collections of 30 bivalves at each site were made just before or during early stages of the spawning cycle so that tissue lipid levels presumably would approach the maximum.

There were 178 samples; replicate collections were made at 89 stations in 87 estuaries. Depending on the availability, seven species of mollusks were used including the freshwater Asiatic clam, *Corbicula manilensis;* eastern oyster, *Crassostrea virginica;* Pacific oyster, *C. gigas;* Atlantic ribbed mussel, *Geukensia demissa;* northern quahog, *Mercenaria mercenaria;* soft-shell clam, *Mya arenaria;* and blue mussel, *Mytilus edulis*. Oysters were sampled in 63 estuaries, mussels in 14, and clams in 10 estuaries. However, clams are the least satisfactory as biomonitors (*2*).

Two samples of 15 bivalves each were collected at each station. They were shucked but were not drained, and were homogenized in an electric blender. A single aliquot of about 50 g from each pooled sample was preserved with 50 ml reagent grade methanol and mailed in a methylpentene vial to the EPA Pesticides Monitoring Laboratory in Bay St. Louis, Mississippi, for analysis. Analytical procedures, detailed elsewhere (*3*), permitted the detection of 20 organochlorine and organophosphate pesticides and PCBs (Table 1). In the 1965–72 program, samples were screened routinely for only 11 of the more persistent organochlorine pesticides.

Results and Discussion

The salient feature of the 1977 monitoring data was the absence of detectable pesticide residues in 85 of the 87

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TABLE 1. *Compounds detected by chemical procedures used in monitoring mollusks*

ORGANOCHLORINES	ORGANOPHOSPHATES
Aldrin	Azinphosmethyl
Chlordane	Carbophenothion
ΣDDT	DEF
Dieldrin	Demeton
Endosulfan	Diazinon
Heptachlor	Ethion
Lindane	Malathion
Methoxychlor	Parathion
Mirex	Phorate
PCBs	
Toxaphene	
Trifluralin	

NOTE: Lower detection limit is 10 μg/kg for all compounds except endosulfan, 20 μg/kg; methoxychlor and ethion, 30 μg/kg; mirex, PCBs, toxaphene, carbophenothion, and DEF, 50 μg/kg.

estuaries sampled and the complete absence of PCBs. On the Atlantic coast, oysters from two adjacent New Jersey reefs and one reef on the Delaware side of upper Delaware Bay contained DDE. Average residue in the six samples was 33 ± 15 μg/kg. Oysters from reefs closer to the mouth of the estuary did not contain detectable residues. As recently as 1972, every monthly oyster sample on the New Jersey side of the Bay contained about three times as much DDT as did samples collected in 1977, as well as residues of dieldrin and PCBs. The fauna in Delaware Bay were presumably contaminated by the hundreds of tons of DDT sprayed aerially between 1950 and 1966 to control New Jersey marsh mosquitoes (*4*).

On the Pacific coast, bivalves in only one of the 14 estuaries monitored in California and Washington state contained pesticide residues. Replicate samples of blue mussels from Muga Lagoon, about 35 miles north of Los Angeles, contained DDT and its metabolites, TDE and DDE, at the average level of 122 μg/kg. A decade earlier, monthly samples of mussels from this station contained ΣDDT residues of 500–1,800 μg/kg, as well as traces of dieldrin and endrin.

The reliability of these isolated data in documenting the virtual disappearance of pesticide pollution from estuarine water is dependent on knowledge gained from the earlier program of the seasonal aspects of waterborne pesticide pollution. Monthly samples in that study showed that pesticide residues in intermittently polluted areas were typically present in the spring, and, if continuously present, were usually larger in the spring, presumably the result of increased river runoff.

The decline in pollution is emphasized by comparison of the present data with pesticide residue levels and incidence in bivalves from the same estuaries during the final 12 months of the earlier program (Table 2). This table shows the number of stations monitored in each state in 1977 but does not repeat the 1977 residue data.

Since filter-feeding bivalves purge themselves of organic residues within a few weeks in the absence of continuing pollution (*2*), the 1977 data show essentially the disappearance of pesticides from the water mass. However, there is evidence that persistent pesticides have not disappeared entirely from most of these estuarine ecosystems. During 1972–76, yearling fish of several species were monitored in many of the same estuaries from which bivalves were collected in 1977 (*3*). Samples consisted of 25 whole fish captured twice yearly. In 1976, 68 samples or 36 percent of the 190 samples analyzed contained DDT residues at levels up to 2,500 μg/kg; 22 percent of the samples also contained PCBs.

TABLE 2. *Summary of pesticide residues in estuarine mollusks during the final 12 months of the 1965–72 program in those estuaries re-monitored in 1977*

STATE	FINAL 12 MONTHS	NO. OF STATIONS	NO. OF SAMPLES	% OF SAMPLES WITH DDT	ARITH. MEAN OF DDT, μg/kg	OTHER RESIDUES DETECTED [1]	SPECIES MONITORED [2]
Alabama	1968–69	2	10	100	102	D	2
California	1971–72	14	68	96	81	D,E,P	1,3,4,7
Delaware	1968–69	5	58	74	44	D	2,4,5
Florida	1968–69	6	61	85	308	D	2
Georgia	1971–72	5	60	20	14	D,T,P	2
Maine	1969–70	5	36	14	29	—	6,8
Maryland	1969–70	6	11	64	25	D	2
Mississippi	1971–72	3	30	63	31	—	2
New Jersey	1971–72	3	15	100	74	D,P	2
New York	1971–72	6	67	88	40	D	2,5,7
North Carolina	1971–72	9	88	35	46	D	2
South Carolina	1968–69	7	83	37	24	D,M	2
Texas	1971–72	6	56	73	72	D,E,T,P	2
Virginia	1971–72	6	24	96	36	D,P	2
Washington state	1967–68	6	72	18	20	—	3

[1] D=dieldrin, E=endrin, M=mirex, P=PCB, T=toxaphene.
[2] 1, *Corbicula manilensis*, Asiatic clam; 2, *Crassostrea virginica*, eastern oyster; 3, *C. gigas*, Pacific oyster; 4, *Geukensia demissa*, Atlantic ribbed mussel; 5, *Mercenaria mercenaria*, northern quahog; 6, *Mya arenaria*, soft-shell clam; 7, *Mytilus edulis*, blue mussel.

The residues in fish are probably the result of storage and recycling of synthetic pesticides in different links of the food web. The filter-feeding mollusks present a more realistic picture of the current input of pesticides into the marine environment. However, bivalves must be monitored more frequently to reflect fluctuating pollution patterns.

Acknowledgment

The authors are grateful to the staffs of the many federal, state, and university agencies, all of whom participated enthusiastically in this project.

LITERATURE CITED

(1) *Butler, P. A. 1973.* Organochlorine residues in estuarine mollusks, 1965–72—National Pesticide Monitoring Program. Pestic. Monit. J. 6(4):238–362.

(2) *Butler, P. A. 1966.* Pesticides in the marine environment. J. Appl. Ecol. 3(Suppl.):253–259.

(3) *Butler, P. A., and R. L. Schutzmann. 1978.* Residues of pesticides and PCBs in estuarine fish, 1972–76—National Pesticide Monitoring Program. Pestic. Monit. J. 12(2):51–59.

(4) *Klaas, E. E., and A. A. Belisle. 1977.* Organochlorine pesticide and polychlorinated biphenyl residues in selected fauna from a New Jersey salt marsh—1967 vs. 1973. Pestic. Monit. J. 10(4):149–158.